FINAL
SAMPLING AND ANALYSIS PLAN
FOR RECREATIONAL USER EXPOSURES AT OPERABLE UNIT 5
LIBBY ASBESTOS SUPERFUND SITE
LIBBY, MONTANA

September 8, 2008

Prepared for:
U.S. Environmental Protection Agency
Region 8
Denver, CO

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Final September 8, 2008

Approval Page

This Sampling and Analysis Plan for Recreational User Exposure at Operable Unit 5 of the Libby Asbestos Superfund Site has been prepared by the U.S. Environmental Protection Agency, Region 8, with technical support from Syracuse Research Corporation and CDM, and is approved without conditions.

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05 September 2008
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List of Acronyms

ABS	Activity-Based Sampling
C	Concentration
CFR	Code of Federal Regulation
CO	Colorado
COC	Chain-of-Custody
DQO	Data Quality Objective
eCOC	Electronic Chain-of-Custody
EDD	Electronic Data Deliverable
°F	Fahrenheit
f/cc	Fibers per Cubic Centimeter
FSDS	Field Sample Data Sheets
FTL	Field Team Leader
GSD	Geometric Standard Deviation
HASP	Health and Safety Plan
HAZWOPER	Hazardous Waste Operations and Emergency Response
HQ	Hazard Quotient
IDW	Investigation-Derived Waste
IFM	Investigation Field Manager
ISO	International Organization for Standardization
L	Liter
LA	Libby Amphibole
MA	Massachusetts
MCE	Mixed Cellulose Ester
MET	Metereological
mm	millimeter
mph	miles per hour
MT	Montana
NOAA	National Oceanic Atmospheric Administration
OU	Operable Unit
PCM	Phase Contract Microscopy
PLN	Poisson Lognormal
PPE	Personal Protective Equipment
QA	Quality Assurance
QC	Quality Control
RBC	Risk-Based Concentration
RBF	Risk-Based Fraction
RfC	Reference Concentration
SAP	Sampling and Analysis Plan
Site	Libby Asbestos Superfund Site
SOP	Standard Operating Procedure
SRC	Syracuse Research Corporation
TEM	Transmission Electron Microscopy
TWF	Time Weighting Factor

UCL	Upper Confidence Limit
UR	Unit Risk
USEPA	U.S. Environmental Protection Agency
µm	micrometer

1.0 INTRODUCTION

This sampling and analysis plan (SAP) describes the collection and analysis of personal air samples to estimate the exposures of current or hypothetical future outdoor recreational visitors who may disturb soil along the hiking/bicycle path in operable unit 5 (OU5) of the Libby Asbestos Superfund Site (Site). This SAP contains all the elements of a field sampling plan and quality assurance project plan and has been developed in accordance with the U.S. Environmental Protection Agency (USEPA) Requirements for Quality Assurance Project Plans (USEPA 2001) and the Guidance on Systematic Planning Using the Data Quality Objectives Process – USEPA QA/G4 (USEPA 2006). The SAP is organized as follows:

Section 1 – Introduction
Section 2 – Site Description and History
Section 3 – Data Quality Objectives (DQOs)
Section 4 – Sampling Program
Section 5 – Laboratory Analysis Requirements
Section 6 – References
Appendices

1.1 Objectives

Previous investigations have determined that Libby Amphibole asbestos (LA) is present in soil and air at OU5. Therefore, individuals who participate in recreational activities at OU5 could be exposed to LA in soil and/or air. However, the existing data set is not sufficient to estimate the level of LA exposure to recreational users at OU5. Therefore, the objective of this SAP is to collect data of sufficient representativeness and quality to estimate the average level of asbestos exposure that occurs to individuals who participate in outdoor recreational activities along the hiking/bicycle path in OU5.

1.2 Project Schedule

Eight sampling events, spanning 4 days (2 sampling events per day) are expected to be conducted in the interval between September and October 2008.

2.0 SITE DESCRIPTION AND HISTORY

Libby is a community in northwestern Montana located near an open pit vermiculite mine that operated from the 1920's until 1990. The mine began limited operations in the 1920's and was operated on a larger scale by the W. R. Grace Company from approximately 1963 to 1990. Studies at the site reveal that the vermiculite from the mine contains amphibole-type asbestos, referred to in this report as LA. Epidemiological studies at the site revealed that workers at the mine had an increased risk of developing asbestos-related lung disease (McDonald et al. 1986, Amandus and Wheeler 1987, Amandus et al. 1987a, b, Sullivan 2007, Rohs et al. 2007). In 2003, Peipins et al. demonstrated radiographic abnormalities in 17.8% of the general population of Libby including former workers, family members of workers, and individuals with no specific pathway of exposure. Although the mine has ceased operations, historic or continuing releases of LA from mine-related materials could be serving as a source of on-going exposure and risk to current and future residents and workers in the area. Since 1999, USEPA has conducted sampling and cleanup activities at the Site related to asbestos-related health problems in the Libby population. The site was listed on the Superfund National Priority List in February 2002.

The Site has been subdivided into seven operable units to facilitate a phased cleanup approach. OU5 is defined geographically by the parcels of land that include the former Stimson Lumber Mill (Figure 2-1). Historical information regarding the Stimson property suggests that asbestos-containing vermiculite products were used at, or transported to, the OU at various times.

Under current site conditions, many areas of the OU are vacant, although some are used for commercial or industrial operations. A small portion of the OU, located along the eastern and northern boundaries of the site, is currently used for recreational activities such as hiking, bicycle riding, and bird watching (Figure 2-1). Additionally, a paved walking path is proposed that would join the current path with the western portion of OU5 by crossing Libby Creek; however, the timeline for implementation is unknown and this SAP only addresses the current path. Future development plans for the OU call mainly for ongoing redevelopment of commercial and industrial operations.

2.1 Conceptual Site Model

The path is currently used for recreational activities (e.g., walking, riding bicycles or all-terrain vehicles, etc.) and is expected to be used in this capacity in the future. Users of this area could be exposed to LA in the soil and/or air resulting from traveling on the path. A conceptual site model for OU5 is shown in Figure 2-2. The pathways of concern to be evaluated specific to the hiking/bicycle path by the sampling described in this SAP are highlighted in Figure 2-2. Additional pathways of concern have been evaluated by past sampling plans or by sampling plans that are currently in development.

3.0 DATA QUALITY OBJECTIVES

The DQO process is a series of planning steps that are designed to ensure that the type, quantity, and quality of environmental data used in decision-making are appropriate for the intended purpose. USEPA has issued guidelines to help data users develop site-specific DQOs (USEPA 2006). These guidelines were followed for the development of the DQOs presented in this section.

The DQO process specifies project decisions, the data quality required to support those decisions, specific data types needed, data collection requirements, and analytical techniques necessary to generate the specified data quality. The DQO process consists of seven steps; output from each step influences the choices that will be made later in the process. These steps include:

1. State the problem
2. Identify the decision
3. Identify the inputs to the decision
4. Define the study boundaries
5. Develop a decision rule
6. Specify tolerable limits on decision errors
7. Optimize the design

These steps are implemented below.

3.1 Step 1 – State the Problem

The purpose of this step is to describe the problem to be studied so that the focus of the investigation will be unambiguous.

The problem to be addressed in this effort is that current or future outdoor recreational visitors using the hiking/bicycle path in OU5 may disturb soil along the path, resulting in release of LA from the soil into breathing zone air. However, available data are not sufficient to estimate the levels of LA in air that may be encountered. These data are needed to determine if the path is currently acceptable for recreational use, or if a response action is required to protect the health of those who use the hiking/bicycle path in OU5.

3.2 Step 2 – *Identify the Decision*

This step identifies what questions the investigation will attempt to resolve and what actions may result.

The decision to be made is whether or not USEPA needs to take any response action along the current hiking/bicycle path in OU5 to ensure health protection for current or future outdoor recreational users who may be exposed by activities that disturb

contaminated soil along the path.

Note: In making this decision, it is important to emphasize that the basis for assessing human health risk from cancer due to asbestos exposure is currently undergoing USEPA review, and the approach may be revised in the future as new methods are developed and as new toxicity data on asbestos are obtained. In addition, USEPA has not yet developed a method for assessing non-cancer risks from inhalation exposure to asbestos. Thus, all evaluations of public health protectiveness that are based on currently available risk assessment methods should be viewed as interim, and these interim decisions may be revised in the future as methods and data for assessing the cancer and non-cancer risks of asbestos are improved.

3.3 Step 3 – Identify the Inputs to the Decision

The purpose of this step is to identify the environmental data that need to be obtained and measurements that need to be taken to resolve the decision statement.

The primary data needed to achieve the objective of this effort consist of reliable and representative measurements of LA concentrations in air within the breathing zone of individuals who disturb soil while engaged in activities that are representative of the range of activities that might occur in this area. For convenience, collection of personal air monitoring samples from individuals who are engaged in activities that may cause release of asbestos from soil into air is referred to as "activity-based sampling" (ABS).

The surface of the bicycle path is varied and includes portions that are or will be paved by September 2008 and other areas that are gravel and/or dirt. The degree of soil disturbance on paved roads is expected to be small compared to unpaved surfaces. Hence, the potential exposure of recreational users to LA along the path will vary. Therefore, in order to make cleanup decisions regarding the path, separate sampling of paved versus unpaved paths is needed.

3.3.1 Soil Condition Data

The amount of LA released from an ABS event depends on both the level of contamination in the soil and the condition of the soil at the time of the ABS event. Characterization of LA levels in source materials (e.g., soil) is often included as part of an ABS study, in part to support extrapolation of results to other locations. However, in this case, soil sampling will not be conducted due to the unique, varying surface composition of the bicycle path. Because of the varying surface it will not be possible to extrapolate the ABS data collected at this location to other locations at the Site. Future soil sampling may be needed to identify potential target areas for cleanup if it is determined that a response action is needed on the bicycle path.

The following data items will be collected to characterize the condition of the soil at time of sampling:

- Soil moisture
- Soil texture
- Nature and extent of ground cover

3.3.2 Types of Air Samples

Experience at Libby and at other sites has demonstrated that, in general, higher concentrations of asbestos are measured in personal air samples (i.e., samples that collect air in the breathing zone of a person) than air samples collected by a stationary monitor, especially if the person is engaged in an activity that disturbs an asbestos source such as contaminated soil. Because of this, this SAP will focus on the collection of personal air samples during ABS.

3.3.3 Target Analyte List

Each air sample will be analyzed for asbestos. Specific methods and counting rules are provided in Section 5. Results will include the size (length, width) of each particle, along with the mineral classification (LA, other amphibole, chrysotile).

3.4 Step 4 – Define the Boundaries of the Study

Activity Bounds

There is a wide range of activities that may occur along the path, including hiking, jogging, bird watching, and bicycle riding. Although the level of exposure is likely to vary between these different activities, it is not necessary to investigate each type of activity separately. Rather, for the purposes of this assessment, attention is focused on exposures associated with riding bicycles along the path. This activity is selected because it is believed that soil disturbances associated with this activity will be at the high end of the range of possible activities.

In addition, very young children may be exposed during bicycle riding activities via transport in an attached bicycle trailer. Therefore, an attached trailer will also be used in this activity scenario for areas of the bicycle path sufficient to allow trailer access. Appendix A provides a detailed "script" for how the bicycle riding ABS scenario will be implemented.

Spatial Bounds

This investigation is limited to the current hiking/bicycle path located along the eastern and northern bounds of OU5 (Figure 2-1).

Temporal Bounds

The releasability of LA from soil to air is expected to vary as a function of time (season) due to variations in soil moisture content, ground cover, and weather conditions. Therefore, characterization of LA levels in ABS air samples requires collection of samples at repeated times during the year. For the purposes of this effort, sampling will

occur over a relatively narrow time window (late summer and early fall of 2008). This time period is likely to represent the high end of the LA-releasability range, since soils are likely to be relatively dry in this time interval. Sampling in other seasons (e.g., spring) may be performed at a later date, depending on how the data estimate the mean exposure and the uncertainty around the exposure as discussed in Section 3.7.

During days when ABS activities are scheduled on the path, meteorological (MET) weather station data will be downloaded from the local National Oceanic Atmospheric Administration (NOAA) station.

3.5 Step 5 – Develop Decision Rules

USEPA has not determined a final decision rule for assessing human health protectiveness at the Site, but it is expected that the rule which will ultimately be adopted will take a form similar to the following:

> If the level of risk to recreational users at a specified sub-area of OU5, when combined with the level of risk which applies to the same individuals from other applicable exposure pathways, does not exceed a cancer risk of 1E-04 or a non-cancer Hazard Quotient (HQ) of 1.0, then risks at that sub-area will be considered acceptable. If the total risk exceeds a cancer risk of 1E-04 or an HQ of 1.0, then the feasibility of further reducing exposure from the outdoor air pathway and/or the other applicable exposure pathways shall be assessed.

At present, USEPA has not developed a quantitative procedure for evaluating non-cancer risks, but has developed a method for quantification of cancer risk (IRIS 2007). The basic equation is:

$$Risk(i) = C(i) \cdot TWF(i) \cdot UR(i)$$

where:

Risk(i) = Risk of dying from a cancer that results as a consequence of exposure from specified exposure scenario "i"

C(i) = Average concentration of asbestos fibers in air (fibers/cubic centimeter [f/cc]) during exposure scenario "i"

TWF(i)= Time weighting factor for exposure scenario "i". This factor accounts for less-than-continuous exposure during the exposure interval.

UR(i) = Unit Risk (f/cc)-1 that is appropriate for exposure scenario "i"

As noted above, because of limitations in the current methods for assessing risks from asbestos, all decisions regarding residual risk levels are considered interim, and interim decisions may be revisited in the future as new methods and new data become available.

3.6 Step 6 – Specify Tolerable Limits on Decision Errors

In making decisions about the long-term average concentration of LA in outdoor air and the level of health risk associated with that exposure, two types of decision errors are possible:

1. A false negative decision error would occur if a risk manager decides that exposure to LA in outdoor air is not of significant health concern, when in fact it is of concern.

2. A false positive decision error would occur if a risk manager decides that exposure to LA in outdoor air is above a level of concern, when in fact it is not.

USEPA is most concerned about guarding against the occurrence of false negative decision errors, since an error of this type may leave humans exposed to unacceptable levels of LA in outdoor air. For this reason, it is anticipated that decisions regarding this pathway will be based not only on the best estimate of the long term average concentration, but will also consider the 95% upper confidence limit (UCL) of the long-term average concentration. Use of the UCL to estimate exposure and risk helps account for limitations in the data, and provides a margin of safety in the risk calculations, ensuring that risk estimates are unlikely to be too low.

USEPA is also concerned with the probability of making false positive decision errors. Although this type of decision error does not result in unacceptable human exposure, it may result in unnecessary expenditure of resources. For the purposes of this effort, the strategy adopted for controlling false positive decision errors is to seek to ensure that, if the exposure estimate based on the 95% UCL is above USEPA's level of concern for this pathway, then the UCL is not larger than 3-times the best estimate of the mean. If the 95% UCL is at or above the range that is of potential concern, and the UCL is greater than 3 times the best estimate of the mean, then it will be concluded that there is a substantial probability of a false positive error and that more data may be needed to strengthen decision-making.

3.7 Step 7 – Optimize the Design for Obtaining Data

The method used to compute the UCL of a set of outdoor air samples depends on the statistical properties of the data set. If it is assumed that the variability between different samples is likely to be approximately lognormal, then the data set collected from a location or a set of similar locations may be approximated by a mixed Poisson lognormal

(PLN) distribution. At present, the USEPA has not established a method for quantifying the uncertainty in the mean of a data set drawn from a PLN distribution, so it is not currently possible to perform a quantitative analysis of decision error rates as a function of sample size. However, it is known that the magnitude of the uncertainty around an observed sample mean depends on three key variables:

- as the variability in the underlying distribution (geometric standard deviation [GSD]) increases, uncertainty increases
- as the number of samples collected increases, uncertainty decreases
- as the number of particles counted per sample (lamda) increases, uncertainty decreases

The relationship between these three variables and the sampling distribution of the mean of a PLN can be characterized using Monte Carlo simulation. For the purposes of this effort, the underlying distribution was assumed to be lognormal with a GSD of 3, 6 or 10. Random data sets of varying sample size (5 to 80) were drawn. Each sample was assumed to be analyzed by a procedure with random Poisson counting error, with the average number of particles counted per analysis (lamda) ranging from 3 to 20. The mean of each simulated data set was computed, and divided by the true mean in order to normalize the values.

The results (presented as the range from the 5th percentile to the 95th percentile of the ratio of the simulated mean divided by the true mean) are shown in Figure 3-1. As seen, relatively little reduction in variability is gained by increasing lamda from 5 to 20, so analytical strategies designed to yield an average of 5 or more particles per sample are considered appropriate. The number of samples needed to limit the uncertainty in the mean to an acceptable level depends on how close the mean is to the decision criterion and on the degree of underlying variability (as reflected in the GSD). If the GSD is not excessive (e.g., about 3-6), and if the mean is well removed from a level of concern (e.g., more than a factor of 3), then the number of samples needed is likely on the order of 10 to 15, depending on the degree of underlying variability. If the mean is close to a level of concern (e.g., less than a factor of 2), then the number of samples needed is likely on the order of at least 25 to 50, depending on the underlying variability (GSD).

At present, data are not available to estimate how close the mean is to a level of concern, or on the magnitude of the underlying variability. In the absence of such data, the minimum number of samples to be collected in this effort is 20. This should be sufficient to support decision making if variability is not too high (GSD $\approx$ 3) and if the observed mean concentration is not too close to decision thresholds (e.g., more than a factor of 3). Additional sampling may be needed to support decision-making if variability is high (e.g., GSD > 3) and/or observed means are close to decision thresholds (e.g., sample

mean is within 3-fold of the decision threshold). This evaluation will be guided by the relationships illustrated in Figure 3-1.

Estimating the Required Analytical Sensitivity
For the purposes of this effort, the analytical sensitivity that is needed for analysis of outdoor air samples is estimated in a series of steps, as follows:

1. Select a risk level of potential concern
2. Calculate the concentration of LA that corresponds to the selected risk level
3. Set the target analytical sensitivity such that, if the average concentration of LA were close to the concentration of concern, the analysis would yield a reliable quantification of the concentration

The level of potential concern selected for computing the analytical sensitivity for the outdoor recreational user scenario is a cancer risk of 1E-05 (1 in 100,000) or a non-cancer HQ of 0.1. These levels are 1/10 the total level of concern to USEPA.

Calculate the Risk-Based Concentration
The concentration of LA in outdoor air that is associated with a risk level of 1E-05 is referred to as the risk-based concentration (RBC), and is calculated from the basic risk equations described above by solving for the concentration that yields a risk of 1E-05:

$$RBC = 1E\text{-}05 / (TWF \bullet UR)$$

Note that the RBC is expressed in terms of the type of fibers defined by the risk model. For example, the current USEPA approach is based on phase contrast microscopy (PCM) fibers, which are defined as asbestos fibers longer than 5 micrometers (μm), thicker than 0.25 μm, and with an aspect ratio greater than 3:1. For convenience, the fibers used in a risk model are called "risk-based fibers". In most cases, the risk-based fibers are only a sub-set of the total asbestos fibers present in air. The fraction of fibers that are risk-based is referred to as the "risk-based fraction" (RBF):

$$RBF = C(\text{risk-based}) / C(\text{total})$$

Combining yields:

$$RBC\ (\text{total LA f/cc}) = 1E\text{-}05 / (RBF \bullet TWF \bullet UR)$$

The value of RBF (the fraction of total LA fibers that are PCM equivalent fibers) for OU5 is not known, but data collected during ABS studies at other parts of the Site indicate a value of about 0.3 to 0.5. Based on this, a value of 0.4 is assumed for these calculations.

Site-specific data on frequency and duration of recreational user exposures during soil disturbance activities are not currently available. For the purposes of sampling described in this SAP, there are two types of receptors of interest: one of an adult bicycle rider and a second receptor which is a small child riding in an attached trailer. For the purposes of this sampling design, the following activity parameters are assumed based on professional judgment:

(1) Adult Bicycle Rider

- Exposure time = 2 hours per day
- Exposure frequency = 90 days per year
- Exposure duration = age 15 to age 45

(2) Child Passenger

- Exposure time = 2 hours per day
- Exposure frequency = 90 days per year
- Exposure duration = age 1 to age 6

Based on this, the value of TWF is computed as follows:

$$TWF = 2 \text{ hr}/24 \text{ hr} \cdot 90 \text{ days}/ 365 \text{ days} = 0.021$$

The value of UR is based on exposure duration. For an adult, the exposure duration is assumed to be 30 years from age 15 to 45; for a child, the exposure duration is 5 years, from age 1 to 6. UR is derived by extrapolation from the table of unit risk values reported in USEPA, 1986. Based on the extrapolation, the values of unit risks for these scenarios are:

(1) Adult: $UR_{15\text{-}45} = 0.093 \text{ (PCM f/cc)}^{-1}$

(2) Child: $UR_{1\text{-}6} = 0.045 \text{ (PCM f/cc)}^{-1}$

Based on these inputs, the concentration of LA in air that corresponds to a risk of 1E-05 in recreational users is calculated as:

(1) Adult: $RBC_A = (1E\text{-}05) / (0.4 \cdot 0.021 \cdot 0.093) = 0.013$ total LA f/cc
(2) Child: $RBC_C = (1E\text{-}05) / (0.4 \cdot 0.021 \cdot 0.045) = 0.027$ total LA f/cc

Select the Target Analytical Sensitivity

In order to ensure that this concentration would be readily detectable if it were present, the target analytical sensitivity is set to a level about 1/2 the lowest calculated RBC:

$$S = 0.006 \text{ cc}^{-1}$$

As noted above, the USEPA has not yet developed a method for evaluating non-cancer risks from asbestos, so it is not yet possible to compute an analogous level of concern for non-cancer effects. In the absence of data, it is tentatively assumed that the target analytical sensitivity that is adequate for evaluating cancer risk will also be sufficient for evaluating non-cancer risks. USEPA toxicologists are currently working to develop an reference concentration (RfC) for asbestos based on available data on LA and other forms of asbestos, and this assumption will be re-visited when an RfC is approved for use.

A summary of the design details presented in this section can be found in Table 3-1.

4.0 SAMPLING PROGRAM

This section provides the details related to the sampling program required to meet the DQOs (Section 3).

4.1 Pre-Sampling Activities

Prior to beginning field sampling activities, a field planning meeting will be conducted, any required trainings will be conducted, and an inventory of equipment and supplies will be performed to ensure that all necessary supplies and equipment are available and in good working order.

4.1.1 Field Planning Meeting

The field planning meeting will be conducted by the assigned CDM field team leader (FTL) and attended by the field staff, a member of the CDM quality assurance (QA) staff, a member of the CDM field health and safety staff. The USEPA remedial project manager will be notified of the meeting's date and time. The agenda will be reviewed and approved by the QA staff and the health and safety officer prior to the meeting. The meeting will briefly discuss and clarify the following:

- Objectives and scope of the fieldwork
- Equipment and training needs
- Field operating procedures, schedules of events, and individual assignments
- Required quality control (QC) measures
- Health and safety requirements
- Documents governing fieldwork that must be on site
- Any changes in the field planning documents

A written agenda, reviewed by the CDM QA staff, will be distributed and an attendance list signed. Copies of these documents are maintained in the project files, in the CDM Denver, Colorado (CO) office. Additional meetings will be held when the documents governing fieldwork require it or when the scope of the assignment changes significantly. The field team personnel will perform the following activities before and during field activities, as applicable:

- Review and understand applicable governing documents
- Ensure that all sample analyses are scheduled through the laboratory
- Obtain required supplies

- Obtain and check field sampling equipment
- Obtain and maintain personal protective equipment (PPE)

4.1.2 Training Requirements

Prior to starting work at the Libby field office, any new team member must complete the following, at a minimum:

- Read the Comprehensive Site Health and Safety Plan (HASP) (CDM 2006) – documented on plan signature sheet and required reading report
- Read the Libby Asbestos Project HASP (CDM 2008a) – documented on plan signature sheet and required reading report
- Read the HASP for Recreational User ABS in OU5- documented on plan signature sheet and required reading report
- Attend an orientation session with the site health and safety officer – documented on orientation session attendance sheet
- Read and understand all relevant governing documents – documented on required reading report
- Occupational Safety and Health Administration 40 hour Hazardous Waste Operations and Emergency Response (HAZWOPER) and relevant 8 hour refreshers – documented by training certificates
- Current 40 hour HAZWOPER Medical Clearance
- Respiratory protection training as required by 29 Code of Federal Regulations (CFR) 1910.134 – documented by training certificate
- Asbestos awareness training as required by 29 CFR 1910.1001 – documented by training certificate
- Sample collection techniques – documented by logbook entries

All training documentation will be stored in the Libby project files.

4.1.3 Inventory and Procurement of Equipment and Supplies

The following equipment will be required for sampling activities, and any required equipment not already contained in the field equipment supply inventory will be procured prior to initiation of sampling activities:

- Field logbooks
- Indelible ink pens

- Digital camera
- Video camera
- 3 Bicycles capable of off-road travel with rear mounted shelf
- Bicycle helmets
- Bicycle trailer attachment capable of carrying a child up to 50 pounds
- Air sampling equipment:
    - 25 millimeter (mm) diameter mixed cellulose ester (MCE) filter cassettes (0.8 μm pore)
    - High flow rate, battery-powered air sampling pumps
    - Rotameter
- Sample paperwork and sample tags/labels
- Custody seals
- Zipper-top baggies
- PPE as required by the HASP

4.2 Sampling Locations

Approximately one third of the bicycle path is or will be paved by September 2008 (Figure 4-1). If the bicycle path north of 5th Street Extension is not entirely paved (as shown on Figure 4-1) by the time sampling begins, then only the portion of the path that is paved will be sampled. The remaining sections of the hiking/bicycle path (south of 5th Street Extension) are mostly unpaved and are either dirt or gravel, or a mixture of both. Among unpaved portions, the path appears to be most heavily used along Libby Creek. The final extent of the path sampled will be indicated on a field sketch and notated in the filed logbook and will be dependent on site conditions at the time of sampling. Sampling events have been divided into 2 parts: paved sections and unpaved sections. The bicycle routes for both scenarios are shown in Figure 4-1.

4.3 Soil Condition Data

For the unpaved portion of the hiking/bicycle path the following information will be collected to describe the condition of the soil at the time of ABS: soil moisture, soil texture, extent of ground cover.

Soil moisture will be estimated daily for the unpaved portion of the path by the hand appearance method that provides results in percent of field capacity. This is performed by firmly squeezing a handful of soil and comparing the results to the table below. Soil used for this evaluation will be collected from a minimum of 5 locations between 0 and 2 inches below ground surface. There is not a lower limit for soil moisture deficiency but

ABS scenarios will not be conducted if standing water or rain is observed within the scenario area during sampling. The soil moisture result for each area will be recorded in the field logbook.

Field Test for Moisture Content – Interpretation Table			
% Soil Moisture Deficiency	Moderately coarse texture	Medium texture	Fine and very fine texture
0 (field capacity)	Upon squeezing, no free water appears on soil but wet outline of ball is left on hand.		
0 to 25	Forms weak ball, breaks easily when bounced in hand.*	Forms ball, very pliable, slicks readily.*	Easily ribbons out between thumb and forefinger.*
25 to 50	Will form ball, but falls apart when bounced in hand.*	Forms ball, slicks under pressure.*	Forms ball, will ribbon out between thumb and forefinger.*
50 to 75	Appears dry, will not form ball with pressure.*	Crumbly, holds together from pressure.*	Somewhat pliable, will ball under pressure.*
75 to 100	Dry, loose, flows through fingers.	Powdery, crumbles easily.	Hard, difficult to break into powder.
*Squeeze a handful of soil firmly to make ball test.			

Soil texture of the path will be determined at the start of the sampling event as prescribed by United States Department of Agriculture, Natural Resources Conservation Service techniques (Appendix B). The result will be recorded in the field logbook.

Extent of vegetative and other ground cover (e.g., broken asphalt, gravel) will be estimated at the start the sampling event and will be recorded in the field logbook.

4.4 Air Sample Collection

Personal air samples will be collected from USEPA contractors who will perform a bicycling activity in accordance with the recreational user script provided in Appendix A. The goal is to collect a minimum of 24 ABS samples from each portion of the path, with these samples being spaced out over time to ensure temporal representativeness within the time frame investigated. Based on this, 3 USEPA contractors will ride bicycles along the path in its entirety twice per day on each of 4 separate days. This scenario will be conducted separately for both the paved and unpaved portions of the bicycle path. The total number of samples (48) is expected to yield an estimate of the mean concentration of LA in the breathing zone of recreational users that has acceptable uncertainty bounds. In addition, one of the bicycles will have a trailer attachment while traveling over the paved path. An air sample pump with cassette will be mounted inside the trailer to simulate exposure to a young child. The unpaved path is not conducive to a

bicycle trailer because the path is steep and narrow in sections. A total of 8 samples will be collected from the bicycle trailer air sampler (1 sample during each of the 2 rides on each of the 4 days for the paved path). Details of the bicycle attachment are provided in Appendix A.

Standard Operating Procedure (SOP) EPA-Libby-01, Revision 1, March 2001 will be used for collection of personal air samples during this effort. A copy of this SOP is presented in Appendix B. All air samples will be collected using cassettes that contain a 25 mm diameter MCE filter with a pore size of 0.8 μm.

The battery-powered, high flow rate F&J air sampling pump will be mounted to the rear shelf on the bicycle and the monitoring cassette will be fixed in the breathing zone of each participant. The breathing zone can be visualized as a hemisphere approximately 6 to 9 inches around an individual's face. The top cover from the cowl extension on the sampling cassette shall be removed ("open-face") and the cassette oriented face down. The specific air sampling pump model selected for this sampling event is F&J DF-40L-8.

Sampling duration and pump flow rate will be adjusted to yield sample volumes of about 600 liters (L). Assuming that each riding activity lasts about 60 minutes, the pump flow rate will be set to 10 L/minute.

As part of this activity, personal air samples will also be collected on each of the first three days for ongoing health and safety monitoring and are not intended for use in the risk assessment. To differentiate these samples from the other personal air samples collected as part of this sampling effort, "PCM" will be used in the Sample Location Description field of the Field Sample Data Sheet (FSDS). These samples will be collected in accordance with the Response Action SAP, Revision 1 (CDM 2008b) and will represent both the time weighted average and excursion sampling periods.

4.4.1 Pump Calibration

Each personal air sampling pump will be calibrated at the start and end of each sampling period using a rotameter that has been calibrated to a primary calibration source. The primary calibration standard used at the Site is a Bios DryCal® DC-Lite. For pre-sampling purposes, calibration will be considered complete when ±5 percent of the desired flow rate is attained, as determined by three measurements with the calibrator using a cassette reserved for calibration (from the same lot of the sample cassettes to be used in the field). For post-sampling, three separate constant flow calibration readings will be obtained with the sampling cassette inline and those flow readings will be averaged. If the flow rate changes by more than 5 percent during the sampling period, the average of the pre- and post-sampling rates will be used to calculate the total sample volume.

To prevent potential cross-contamination, each rotameter used for field calibration will be transported to and from each sampling location in a sealed zip-top plastic bag. The cap used at the end of the rotameter tubing will be replaced each morning after it is used.

Samples for which there is more than a 25% difference from initial calibration to end calibration will be invalidated. The sample collector will record the pump serial number, sample number, initial flow rate, sample start/end times, sample locations, and final flow rate in both the field logbook and on a FSDS.

4.4.2 MET Station Data

During days when ABS activities are occurring, MET station data will be downloaded from the local NOAA station, LBBM8. The following parameters are recorded hourly at this station:

- temperature (degrees Fahrenheit [°F])
- dew point (°F)
- relative humidity (%)
- wind speed (miles per hour [mph])
- wind gust (mph)
- wind direction
- solar radiation (watts per square meter per hour)
- precipitation (inches)

Copies of all MET station data will be provided to USEPA and Syracuse Research Corporation (SRC) within one week after the completion of the sampling event. Electronic copies are suitable and will be placed in the project e-room.

4.5 General Processes

4.5.1 Sample Labeling and Identification

Samples will be labeled with index identification numbers supplied by field administrative staff, and will be signed out by the sampling teams (i.e., controlled). For personal air samples, one sample label will be placed on the sampling cassette and the sample identification number will also be written on the outside of the plastic bag used to hold the sampling cassette during transport.

Sample index identification numbers will identify the samples collected during this sampling effort by having the following format:

SL-#####

where:

SL = Stimson Lumber Mill Site
= a sequential five digit number

4.5.2 Field Logbooks

Field logbooks will be maintained in accordance with CDM SOP 4-1, Field Logbook Content and Control with project-specific modifications (Appendix B). The log is an accounting of activities at the site and will duly note problems or deviations from the governing plans and observations related to the SAP.

As described in CDM SOP 4-1, logbook modifications will be completed with a single line strikeout, initial, and date. The correct information should be entered in close proximity to the erroneous entry.

Field logbooks will be completed daily prior to leaving the site. Field logbooks will be checked for completeness and adherence to CDM SOP 4-1, on a daily basis for the first week of each new activity. When incorrect logbook completion procedures are discovered during these checks, the errors will be discussed with the author of the entry and corrected.

The field administrative staff will manage the logbooks by assigning unique identification numbers to each logbook, tracking who each logbook was assigned to, the investigation activities to be recorded in each logbook, the date the logbook was signed out, and the date the logbook was returned. As logbooks are completed, originals will be maintained in the CDM office in Libby, Montana (MT) and copies will be sent for archive to the CDM office in Denver, CO. Copies of logbooks will be provided to USEPA and SRC within one week after the completion of each sampling event. Electronic copies of all logbooks are suitable and will be placed in the project e-room.

4.5.3 FSDSs

Detailed sampling notes as required by media-specific FSDSs will be recorded for each field and QC sample. FSDSs are property-specific and up to 3 individual samples can be recorded on a FSDS from the same property. If columns are left incomplete due to less than three samples being recorded on a sheet, the blank columns will be "Z'ed" out and signed by the staff member completing the sheet. Modifications will be completed with a single line strikeout, initial, and date. For any information mistakenly recorded on a sheet. The correct information should be entered in close proximity to the erroneous entry.

FSDSs will be completed in the field before leaving the sampling location. To ensure that all applicable data is entered and all necessary fields are completed, a different field team member will check each FSDS. Initials are placed on the FSDS indicating the team member who completed the form and the team member who checked the form. In addition, the FTL will also complete periodic checks of FSDS prior to relinquishment to the sample coordinator. Once FSDSs are relinquished to the sample coordination staff, the sheets are again checked for accuracy and completeness. Initials are recorded on the sheet for the member of the sample coordination staff completing the check and data entry of required information into the project sample tracking database, eLASTIC.

During any of these checks, if a revision is required to the FSDS, it will be returned to the team member initially responsible for its completion. The error will be explained to the team member and the sheet corrected.

Each media-specific sheet is assigned a unique identification number. This number will be referenced in logbook entries related to samples recorded on individual sheets. Field administrative staff will manage the FSDSs and will send copies of completed sheets to the project repository at the CDM office in Denver, CO. Original sheets will be filed in the CDM office in Libby, MT by media and individual sheet number.

A copy of the FSDS that will be used to record information collected during the activities described in this SAP is shown in Appendix C. Copies of FSDSs will be provided to USEPA and SRC within one week after the completion of each sampling event. Electronic copies are suitable and will be placed in the project e-room.

4.5.4 Photographic Documentation

Photographs will be collected to document sampling locations and site conditions during cycling activities and at any other place the field sampling personnel determine necessary, with a digital camera in accordance with CDM SOP 4-2, Photographic Documentation of Field Activities (Appendix B) with the project-specific modifications.

Digital photographs will be archived on the CDM Libby Server (secure) with nightly backup. These files will be archived until project closeout, at which point project management will determine a long-term electronic file storage system. Electronic captions will be used to describe the photographs instead of maintaining photographic logs in daily logbook entries. File names will be in the format:

OU5_date

where

OU5 indicates the activity was completed at OU5, and the date is formatted as MM-DD-YY.

4.5.5 Videotape Documentation

A videotape will be prepared to document a representative example of ABS scenarios including any special conditions or circumstances that arose during the activity. File names will be in the same format as photographic documentation listed above.

4.5.6 Field Equipment Maintenance

Field equipment maintenance will be conducted and documented as described in CDM SOP 5-1, Control of Measurement and Test Equipment (Appendix B).

When a piece of equipment is found to be operating incorrectly, the piece of equipment will be labeled out-of-order and placed in a separate area from the rest of the sampling equipment. The person who identified the equipment as out-of-order will notify the FTL overseeing the investigation activities. It is the responsibility of the FTL to facilitate repair of the equipment. This may include having appropriately trained field team members complete the repair or shipment to the manufacturer.

4.5.7 Equipment Decontamination

Decontamination of air sampling pumps will be conducted in accordance with CDM SOP 4-5, Field Equipment Decontamination at Non-radioactive Sites, with project specific modifications (Appendix B). Materials used in the decontamination process will be disposed of as investigation derived waste (IDW) as described below.

4.5.8 Handling IDW

Any disposable equipment or other IDW will be handled in accordance with CDM SOP 2-2 with project-specific modifications, Guide to Handling of IDW (Appendix B).

During periodic evaluations conducted by the FTL, IDW handling will be evaluated. If handling procedures are not following CDM SOP 2-2 and project-specific requirements, the field teams observed will be re-instructed on correct handling procedures.

4.5.9 Field Sample Custody and Documentation

Field sample custody and documentation will follow the requirements as stated in CDM SOP 1-2, Sample Custody with project-specific modification (Appendix B). The chain of custody (COC) is used as physical evidence of sample custody and control. This record system provides the means to identify, track, and monitor each individual sample from the point of collection through final data reporting. A complete COC is required to accompany each shipment of samples.

At the end of each day, all samples will be relinquished to the sample coordinator by the sampling team following COC procedures, and an entry will be made into the logbook indicating the time samples were relinquished. The sample coordinator will follow COC

procedures to ensure proper sample custody from acceptance of the sample from the field teams to shipment to the laboratory.

The sample coordinator assistant will use the FSDS to complete an electronic COC (eCOC). The sample coordinator will use the data entered to create the eCOC and verify the data against the FSDSs. Three paper copies of the eCOC will then be generated. One copy will be filed in the CDM Libby office and the other two will accompany the sample shipment. If any errors are found on an eCOC after shipment, the paper copy of the COC stored at the CDM office in Libby, MT will be corrected by the sample coordinator with a single line strikeout, initial, and date. The corrected copy will be faxed to the Volpe Center in Cambridge, Massachusetts (MA) and the receiving laboratory. The fax to the Volpe Center will be used to update the Libby2 database.

Copies of all COC forms will be provided to USEPA and SRC within one week after the completion of each sampling event. Electronic copies are suitable and will be placed in the project e-room.

4.5.10 Lab Coordination

In order to clearly differentiate the samples collected for this investigation, each COC will reference the SAP-specific Summary of Preparation and Analytical Requirements for Asbestos (provided in Appendix D) in the comments section for each sample. In addition, each COC will be appended with this analytical summary sheet.

4.5.11 Sample Packaging and Shipping

Samples will be packaged and shipped in accordance with CDM's SOP 2-1, Packaging and Shipping of Environmental Samples (Appendix B), with project-specific modifications. For air samples, a custody seal will be placed so that both ends of the sampling cassette are covered by the seal. Custody seals will be placed over at least two sides of the shipment cooler and then secured by tape if samples are released to a non-sampler. The sample coordinator will check the COC versus the samples in the shipment to ensure the COC matches shipment contents.

The sample coordinator will be responsible for shipment of samples. All samples will be shipped by an overnight delivery service to the laboratory designated by the CDM laboratory coordinator or hand-delivered to the onsite laboratory. Vermiculite, shredded paper, or expanded polystyrene cannot be used as packing material.

4.5.12 Modification Documentation Forms

All deviations from this SAP and associated guidance documents will be recorded on the Libby Asbestos Project Record of Modification Form (Appendix E). The Record of Modification Form will be used to document all permanent and temporary changes to procedures contained in guidance documents governing investigation work. In addition,

the Record of Modification Form will be used to document any information of interest as requested by USEPA project management. As modifications to governing documents are implemented, the FTL will communicate the changes to the field teams conducting activities associated with the modification. When the USEPA project management team determines the need, revised governing documents may be issued to incorporate modifications.

Record of Modification Forms are completed by the FTL overseeing the investigation. Once a form is completed a technical review is completed by the Volpe Center project manager or designate, and then reviewed and approved by the USEPA remedial project manager or designate.

A record is kept to track the person each form was completed by and a brief description of the modification documented on each form. Each completed Record of Modification Form is assigned a unique identification number and maintained at the CDM office in Libby, MT by the data manager.

4.5.13 Field Surveillances and Audits

The quality of field processes is evaluated by field surveillances and audits conducted by CDM and/or USEPA. This section describes each of these evaluations.

Field surveillances consist of periodic observations made to evaluate continued adherence to investigation-specific governing documents. Field surveillances are conducted for each investigation conducted at the site, and are most often performed by the CDM investigation field manager (IFM) or investigation assigned FTL.

The schedule for performing field surveillances is dependent on the duration of the investigation, frequency of execution, and magnitude of process changes. At a minimum, field surveillance will be performed daily during the first week of implementation. Following the first week, surveillances will be conducted once a month or as necessary when field processes are revised or other QA/QC procedures indicate potential deficiencies.

When deficiencies are observed during the surveillances, the observer will immediately discuss the observation with the field team member and retrain the team member if required. If the observer finds deficiencies across multiple field members or teams, the IFM or FTL will plan and hold an investigation-specific field meeting. At this meeting the observations made will be discussed as well as any corrective actions required (i.e., retraining).

The observer will document that surveillances have occurred in the appropriate field logbook. The logbook will also be used to record any field meetings that were conducted

including topics discussed, person conducting the meeting, and field team members attending the meeting.

Field audits are broader in scope than surveillances and are independent evaluations conducted by qualified technical or QA staff that are independent of the activities audited. Field audits can be conducted by CDM, internal USEPA staff, or USEPA contracted auditors. Due to the brevity of the recreational user sampling, a field audit is not anticipated.

4.6 QA/QC Activities

QA/QC samples will be collected for air samples according to the procedures and at the frequencies described below. It is expected that drying air sample cassettes will not be required for this activity given the low relative humidity conditions in which sampling will take place. Co-located samples will not be collected due to the replication of air samples collected over the 4-day sampling event. Table 4-1 summarizes the collection frequency for QA samples and indicates corrective actions that may be required based on their results.

Lot blanks – Before samples are collected, cassette lot blanks from each filter lot will be randomly selected and submitted for analysis at a minimum frequency of 1 lot blank per 500 cassettes. The lot blanks will be analyzed for asbestos fibers by the same method as will be used for field sample analysis. The entire batch of cassettes will be rejected if any asbestos fiber is detected on the lot blanks. Only lots of filters with acceptable lot blank results are placed in the general supply area for use by project personnel.

Field blanks – The collection frequency for field blanks will be one field blank for each day when activities are conducted. Field blanks are collected by opening the sample cassette to the ambient environment for 5 to 30 seconds then re-capping the sample cassette. The field blanks will be analyzed for asbestos fibers by the same method as will be used for field sample analysis. It is expected, based on historical analyses of field blanks, asbestos structures will only be observed on field blanks on very rare occasions. If any asbestos structure is observed on a field blank, the Libby2 database will be used to correlate the field blanks to the related field samples. Based on this correlation, a qualifier of "FB" will be added to the results of all samples associated to a field blank with asbestos structures.

5.0 LABORATORY ANALYSIS AND REQUIREMENTS

The laboratories used for all sample analysis will have participated in, and acceptably analyzed, the required parameters in the last two proficiency examinations from the National Institute of Standards and Technology/National Voluntary Laboratory Accreditation Program. The laboratory must also analyze project specific performance evaluation samples or other reference materials when requested. These analyses must be performed before any samples are submitted to the laboratory to confirm the laboratory's capabilities and may be subsequently submitted at regular intervals. In addition, the laboratory must participate in the laboratory training program developed by the Libby laboratory team.

5.1 Analytical Methods

5.1.1 Method Requirements

All air samples collected as part of this effort will be submitted to a subcontracted laboratory for analysis using the International Organization for Standardization (ISO) Transmission Electron Microscopy (TEM) method 10312, also known as ISO 10312:1995(E) (CDM 2005), with all applicable project specific modifications, including LB-000016, LB-000019, LB-000028, LB-000029b, LB-000030, LB-000031a, LB-000053, LB-000066c, LB-000084, and LB-000085 (CDM 2003). All asbestos structures (including not only LA but all other asbestos types as well) that have appropriate diffraction patterns and EDS spectra, and having length greater than or equal to 0.5 μm and an aspect ratio ≥ 3:1, will be recorded on the Libby site-specific laboratory data sheets and electronic deliverables.

The personal air samples collected for the ongoing health and safety monitoring do not require the same target analytical sensitivity as the samples collected in support of the risk assessment. Instead, these samples will be collected and analyzed in accordance with the Response Action SAP, Revision 1 (CDM 2008b) as specified in the Appendix D.

5.1.2 Stopping Rules

For field samples, the initial stopping rules are as follows:

Count the sample until one of the following is achieved:

- A target analytical sensitivity of 0.006 cc^{-1} is achieved
- 50 LA structures are observed
- An area of 0.5 mm^2 of filter has been examined

When one of these goals is achieved, complete the final grid opening and stop. These stopping rules may be revised as data become available on the levels of LA and dust that are collected in the field samples.

For field blanks and lot blanks, examine a filter area of 0.1 mm^2 and stop.

5.1.3 Estimated Filter Area and Grid Opening Requirements

As noted above, the target analytical sensitivity for personal air samples is 0.006 cc^{-1}. Assuming a sample volume of 600 L, and assuming the sample can be evaluated without indirect preparation, the area of filter that must be examined to achieve the target sensitivity is about 0.11 mm^2. For grids with a grid opening area of about 0.01 mm^2, this would correspond to about 11 GOs. For grids with a different grid opening area, the number of GOs needed to achieve the target sensitivity is given by:

$$\text{Target GOs} = EFA / (S \cdot Ago \cdot V \cdot 1000)$$

5.2 Holding Times

No preservation requirements or holding times are established for samples collected for asbestos analysis.

5.3 Laboratory Custody Procedures and Documentation

Laboratory custody procedures are provided in the laboratories' QA management plan, which are reviewed by CDM as part of the laboratory procurement process and were independently audited and found to be satisfactory by USEPA's Laboratory Audit team. The basic laboratory sample custody process is as described herein. Upon receipt at the laboratory, each sample shipment will be inspected to assess the condition of the shipping and the individual samples. This inspection will include verifying sample integrity. The accompanying COC records will be cross-referenced with all of the samples in the shipment. The laboratory sample custodian will sign the COC records and maintain a copy for their project files; the original COC will be appended to the hard copy data report that is sent to CDM's laboratory coordinator. Next, the sample custodian may continue the COC record process by assigning a unique laboratory number to each sample on receipt. This number, if assigned, will identify the sample through all further handling at the laboratory. It is the laboratory's responsibility to maintain internal logbooks and records throughout sample preparation, analysis, and data reporting.

5.4 Documentation and Records

Laboratory documentation and records will follow the requirements outlined below.

5.4.1 Analytical Data Reports

Data reports for all samples will be submitted to the CDM laboratory coordinator and include a case narrative that briefly describes the number of samples, the analyses, and any analytical difficulties or QA/QC issues associated with the submitted samples. The

data report will also include signed COC forms, analytical data summary report pages, a QC package, and raw data, where applicable. Raw data is to consist of instrument preparation logs, instrument printouts, and QC sample results including, instrument maintenance records, COC check in and tracking, raw data instrument print outs of sample results, analysis run logs, and sample preparation logs. All original data reports will be filed in the CDM office in Denver, CO. The laboratory also will provide an electronic copy of the data to the laboratory coordinator and others as directed by CDM.

5.4.2 Laboratory Data Entry Spreadsheets

Standardized data entry spreadsheets (electronic data deliverables [EDDs]) were developed specifically for the Libby project to ensure consistency between laboratories in the presentation and submittal of analytical data. In general, a unique data entry MSExcel workbook template was developed for each type of analytical method (TEM, PCM, PLM). Since the beginning of the Libby project, the EDD has evolved to better accommodate the present and future needs of data handling, retrieval, and interpretation. An on-going refinement of the EDD continues based on laboratory and data user input.

The EDD template contains a variety of built-in quality control functions that improve accuracy of data entry and help maintain data integrity. For example, data entry forms utilize drop-down menus whenever possible to standardize data inputs and prevent transcription errors. In addition, many data input cells are coded to highlight omissions, apparent inconsistencies, or unexpected values so that data entry personnel can check and correct any errors before submittal of the EDD. The spreadsheet workbook also performs automatic computations of sensitivity, dilution factors, and concentration, thus reducing the likelihood of analyst calculation errors. The EDD was designed to directly upload data into the project database, avoiding any additional data entry requirements.

5.4.3 Modification Forms

All deviations from project specific and method guidance documents will be recorded on the Libby Asbestos Project Record of Modification Form to Laboratory Activities. The Record of Modification Form will be used to document all permanent and temporary changes to analytical procedures. In addition, the Record of Modification Form will be used to document any information of interest as requested by USEPA project management. As modifications are implemented, the laboratory coordinator will communicate the changes to the project laboratories.

Record of Modification Forms are completed by the case manager assigned by each laboratory to the Libby project or their designate. Once a form is completed a technical review is completed by the laboratory and the Volpe Center project manger or designate, and then reviewed and approved by the USEPA project leader or designate.

A record is kept to track the person each form was completed by and a brief description of the modification documented on each form. Each completed Record of Modification Form is assigned a unique identification number and maintained by the CDM laboratory coordinator.

5.5 Data Management

Sample results data will be delivered to the Volpe Center in Cambridge, MA and CDM's Cambridge, MA office both in hard copy and as an EDD in the most recent project-specific format. Electronic copies of all project deliverables, including graphics, will be filed by project number. Electronic files will be routinely backed up and archived according to individual laboratory processes.

All results, field data sheet information, and survey forms will be maintained in the Libby project database managed by the Volpe Center under the oversight of the Volpe Center database management team.

6.0 REFERENCES

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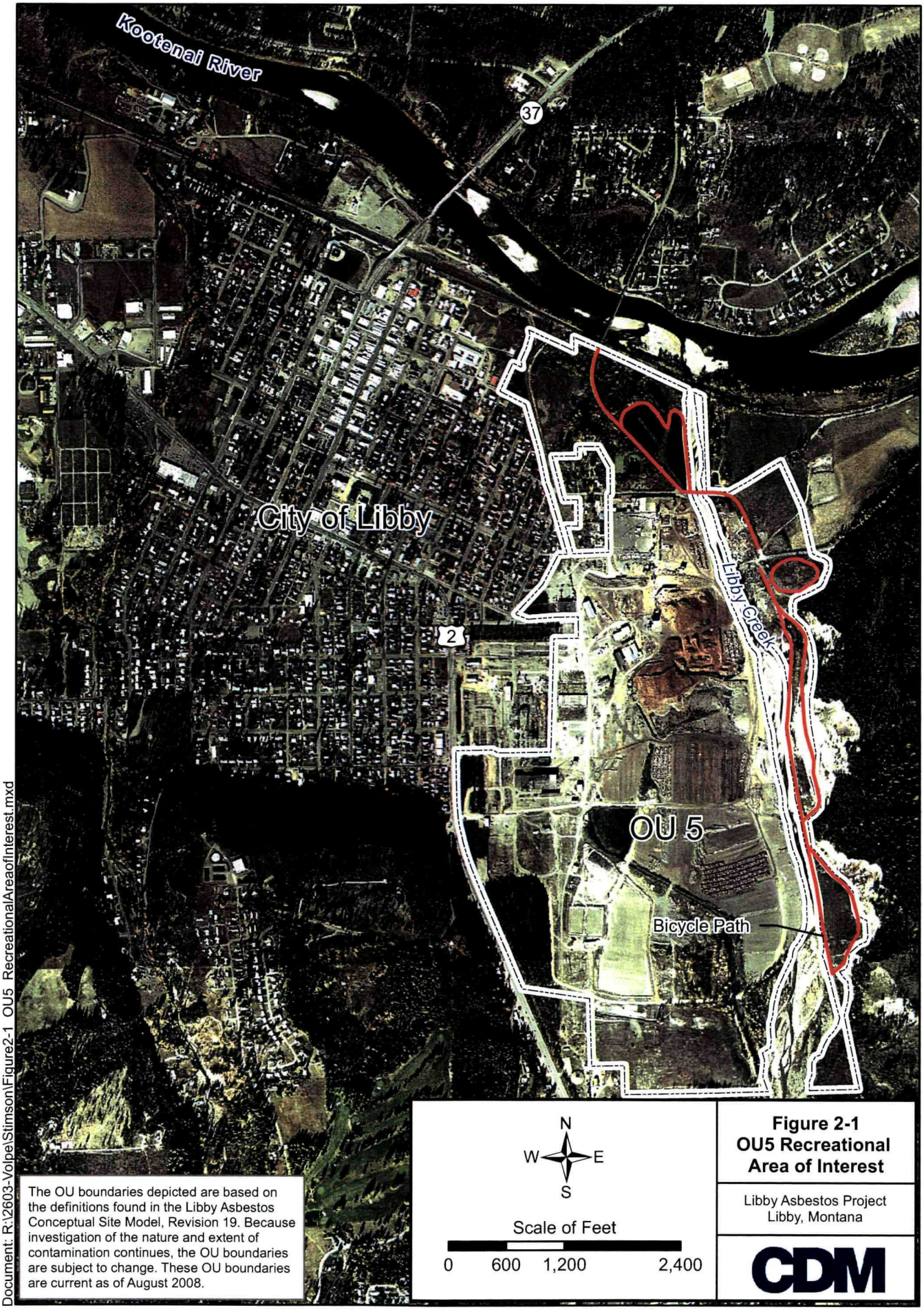


The OU boundaries depicted are based on the definitions found in the Libby Asbestos Conceptual Site Model, Revision 19. Because investigation of the nature and extent of contamination continues, the OU boundaries are subject to change. These OU boundaries are current as of August 2008.

Figure 2-1
OU5 Recreational Area of Interest

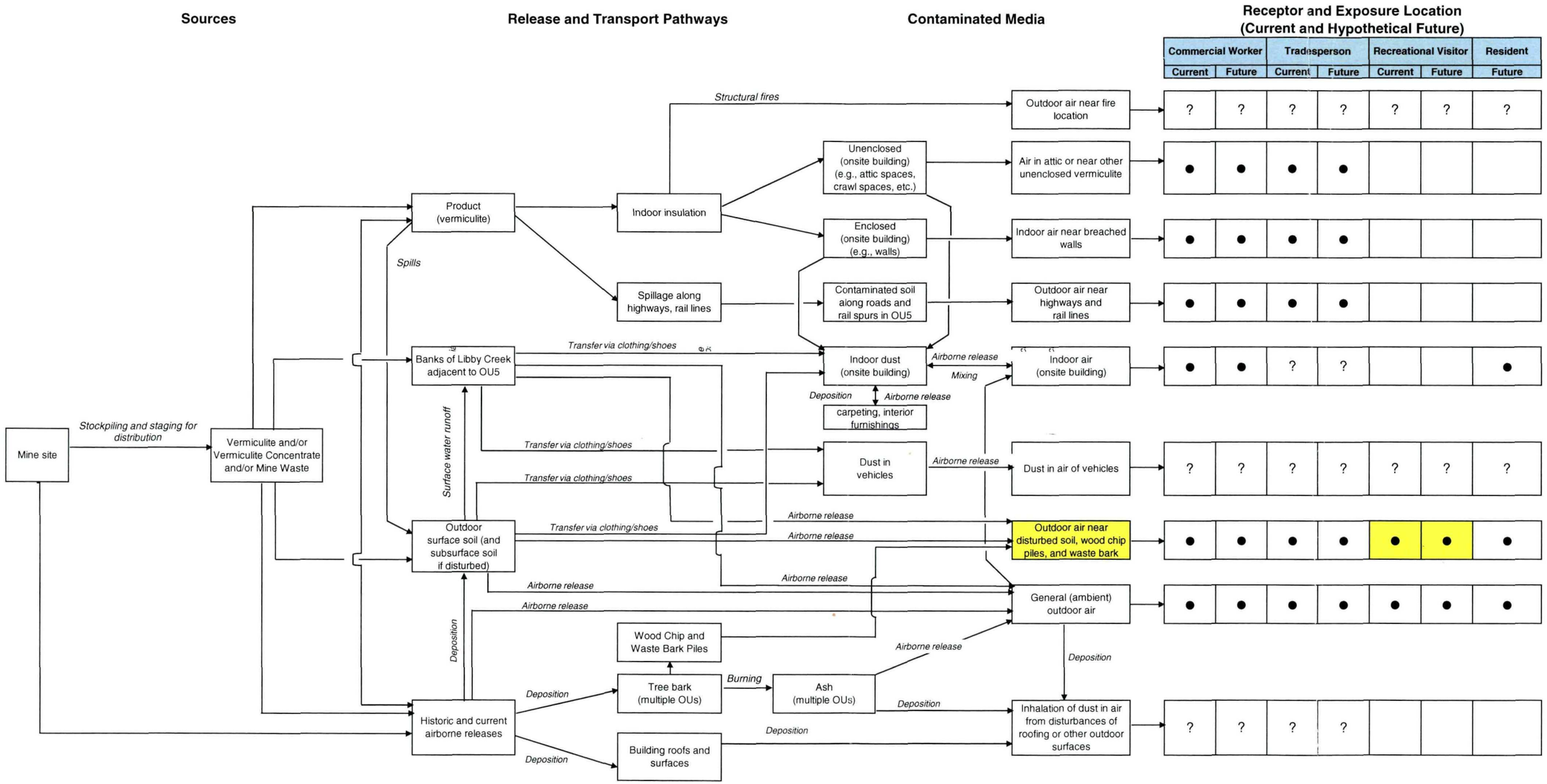
Libby Asbestos Project
Libby, Montana

CDM

Document: R:\2603-Volpe\Stimson\Figure2-1_OU5_RecreationalAreaofInterest.mxd

FIGURE 2-2. CONCEPTUAL SITE MODEL FOR INHALATION EXPOSURES TO ASBESTOS

Libby Superfund Site -- Operable Unit 5 (Former Stimson Lumber Mill)

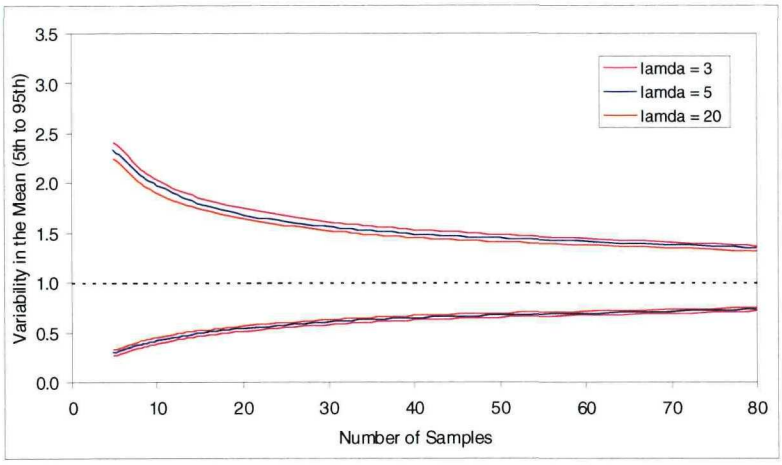


KEY

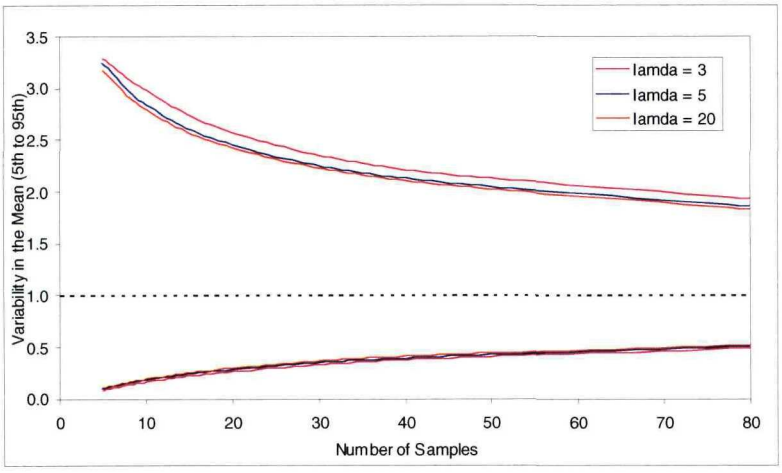
●	Pathway is complete and exposure may be significant; quantitative evaluation is warranted
O	Pathway is complete but is believed to be minor in comparison to other pathways; qualitative evaluation is warranted
?	Pathway may be complete but magnitude of exposure is uncertain; further investigation may be necessary
	Pathway is incomplete or believed to be negligible; further evaluation is not warranted

FIGURE 3-1
EFFECT OF SAMPLE SIZE ON UNCERTAINTY IN THE MEAN

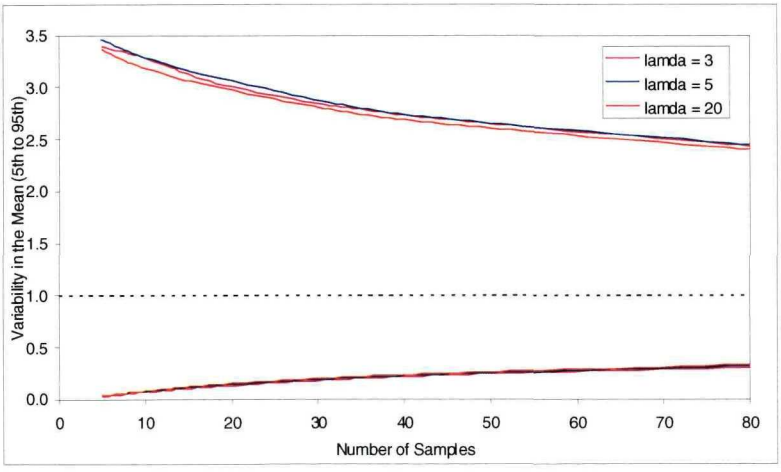
GSD = 3



GSD = 6



GSD = 10



Document: R:\2603-Volpe\Stimson\Figure4-1_BicycleRoutes_PavedandUnpavedABS.mxd

TABLE 3-1 SUMMARY OF RECREATIONAL USER ABS DESIGN

Item	Description
Conceptual Model	See Figure 2-2 (relevant pathway highlighted)
Representativeness	Represents personal air exposures of bicycle riders (up to 3 riding together) or passengers on path in OU5. This is suspected to have same or higher exposure than other activities (hiking, jogging, birdwatching)
Exposure parameters assumed in calculation of target sensitivity	ET = 2 hrs/event EF = 90 events/yr Age at start (adult) = 15; Age at start (child) = 1 ED (adult) = 30 years; ED (child) = 5 years
Toxicity Factors assumed in calculation of RBC	Cancer Target cancer risk = 1E-05 Unit $Risk_{15-45}$ = 0.093 $(PCM\ f/cc\text{-}yrs)^{-1}$ Unit $Risk_{1-6}$ = 0.045 $(PCM\ f/cc\text{-}yrs)^{-1}$ RBC (adult) = 0.013 Total LA f/cc RBC (child) = 0.027 Total LA f/cc Non-Cancer iRfC = NA
Analytical Requirements	Method = ISO 10312 with all applicable site-specific laboratory modifications Target Sensitivity = 0.006 cc^{-1} (corresponds to 5E-06 risk level for adults) Stopping rules: a) Target S (approx 10 GO expected) b) Max GO = 50 c) Max LA = 50
Initial number of samples (a)	3 riders · 2 events/day · 4 days = 24 rider samples per scenario Number of scenarios: 2 (paved, unpaved) 1 trailer · 2 events/day · 4 days = 8 trailer samples (paved scenario only) Total number of samples: 56

(a) The number of samples needed for risk assessment and risk management depends on the inter-sample variability and how close the data are to a decision threshold. This number of samples is expected to provide sufficient information to determine if additional samples are needed, and if so, how many.

TABLE 4-1 SUMMARY OF FIELD QC SAMPLES

Sample Type	Minimum Collection Frequency		Minimum Analysis Frequency	Acceptance Criteria	Acceptance Criteria Failure Action
Lot Blank	1 per 500 cassettes	0.2%	100%	ND for all asbestos	Rejection of all cassettes in lot
Field Blank	1 per day		10% of total collected per week	ND for all asbestos fibers	Analysis of additional field blanks to determine source of potential cross-contamination, qualification of sample results, evaluation of field sample handling procedures

Notes:
QC = quality control
ND = non-detect

APPENDIX A
"SCRIPT" FOR BICYCLE RIDING SCENARIO

"SCRIPT" FOR BICYCLE RIDING SCENARIO

The following is an activity script for the recreational activity participants, which briefly describes the specific type of activity that will be monitored for this SAP.

Recreational equipment operation. Each recreational equipment operator will be assigned a non-motorized, 2-wheel bicycle capable of riding non-paved roads. In addition, for the paved portion of the path, a bicycle trailer capable of hauling a 50-pound child will be affixed to the back of one of the bicycles and a personal air monitor mounted inside the trailer. The cyclists will be monitored along the bicycle routes. Because the goal of the ABS is to collect data exclusively for paved or unpaved portions of the bicycle path, the scenario will be conducted in duplicate: one for the paved portion of the path and one for the unpaved portion of the path.

For each segment (paved or unpaved), a group of 3 riders, with air samplers mounted to the bicycle and the monitoring cassette affixed in the breathing zone, will travel in single file along the bicycle path. The cyclists will ride the entire route (once for paved, once for unpaved) repeatedly for an estimated time of 1 hour. The distance between the riders will be maintained based on visibility, terrain and safety considerations. Riders will change their relative positions (1^{st}, 2^{nd}, 3^{rd}) throughout the scenario. Trailing riders will ride in the dust cloud of the rider in front as much as safe and practical. During these events, the bicycle riders will vary their speed between 3 and 15 mph. Riders will strive for an average speed of 8 mph. The average speed is a target speed only; bicycle speeds will be adjusted to meet path conditions. A total of 2 rides per day on 4 separate days is proposed for each of the 2 types of surface (i.e., paved, unpaved), for a total of 48 samples. In addition, 8 samples will be collected from the bicycle trailer on the paved path.

Equipment decontamination. The bicycles and trailer used during the investigation will be decontaminated at the staging area before leaving the site and between sampling the two types of surfaces (i.e., paved, unpaved). The equipment will be washed using a pressurized water source to separately wash each piece of equipment.

APPENDIX B
STANDARD OPERATING PROCEDURES
(provided electronically)

SOP Description	SOP ID
Sample Custody	CDM SOP 1-2, with modification
Packaging and Shipping of Environmental Samples	CDM SOP 2-1, with modification
Guide to Handling of Investigation-Derived Waste	CDM SOP 2-2, with modification
Field Logbook Content and Control	CDM SOP 4-1, with modification
Photographic Documentation of Field Activities	CDM SOP 4-2, with modification
Field Equipment Decontamination at Nonradioactive Sites	CDM SOP 4-5, with modification
Control of measurement and Test Equipment	CDM SOP 5-1
Sampling of Asbestos Fibers in Air	EPA-LIBBY-01 Rev. 1
Texture Classification; United States Department of Agriculture, Natural Resources Conservation Service	N/A

TARGET SHEET

EPA REGION VIII

SUPERFUND DOCUMENT MANAGEMENT SYSTEM

DOCUMENT NUMBER: 1100455

SITE NAME: LIBBY ASBESTOS

DOCUMENT DATE: 09/08/2008

DOCUMENT NOT SCANNED

Due to one of the following reasons:

- ☐ PHOTOGRAPHS
- ☐ 3-DIMENSIONAL
- ☐ OVERSIZED
- ☑ AUDIO/VISUAL
- ☐ PERMANENTLY BOUND DOCUMENTS
- ☐ POOR LEGIBILITY
- ☐ OTHER
- ☐ NOT AVAILABLE
- ☐ TYPES OF DOCUMENTS NOT TO BE SCANNED
  (Data Packages, Data Validation, Sampling Data, CBI, Chain of Custody)

DOCUMENT DESCRIPTION:

1 CD - APPENDIX B, STANDARD OPERATING PROCEDURES

Contact the Superfund Records Center to view available document.
(303) 312-6473

APPENDIX C
LIBBY FIELD SAMPLE DATA SHEETS FOR PERSONAL AIR

Sheet No.: PA- **00«seq»**

LIBBY FIELD SAMPLE DATA SHEET (FSDS) FOR PERSONAL AIR

Field Logbook No: _____ Page No: _____ Sampling Date: _____

Address: _____ Owner/Tenant: _____

Business Name: _____

Land Use: Residential School Commercial Mining Roadway Other ( )

Sampling Team: CDM Other _____ Names: _____

Person Sampled/Co. Name: _____ / _____ SSN: _____ Task: _____

Data Item	Cassette 1	Cassette 2	Cassette 3
Index ID			
Location ID			
Sample Group			
Location Description			
Category (circle)	FS FB-(field blank) LB-(lot blank)	FS FB-(field blank) LB-(lot blank)	FS FB-(field blank) LB-(lot blank)
Matrix Type (circle)	Indoor Outdoor	Indoor Outdoor	Indoor Outdoor
Filter Diameter (circle)	25mm 37mm	25mm 37mm	25mm 37mm
Pore Size (circle)	TEM- .45 PCM- 0.8	TEM- .45 PCM- 0.8	TEM- .45 PCM- 0.8
Flow Meter Type (circle)	Rotometer DryCal NA	Rotometer DryCal NA	Rotometer DryCal NA
Pump ID Number			
Flow Meter ID No.			
Start Date			
Start Time			
Start Flow (L/min)			
Stop Date			
Stop Time			
Stop Flow (L/min)			
Pump fault? (circle)	No Yes NA	No Yes NA	No Yes NA
MET Station onsite?	No Yes NA	No Yes NA	No Yes NA
Sample Type	TWA EXC NA	TWA EXC NA	TWA EXC NA
Field Comments Cassette Lot Number: _____ Archive Blank (circle): Yes No			
Entered (LFO) _____	Volpe: Entered _____ Validated _____	Volpe: Entered _____ Validated _____	Volpe: Entered _____ Validated _____

For Field Team Completion (Provide Initials)	Completed by	QC by

vs 042308

APPENDIX D
SUMMARY OF PREPARATION AND ANALYTICAL REQUIREMENTS FOR ASBESTOS

SAP ANALYTICAL SUMMARY # OU5RECUS (SRC 2008)
SUMMARY OF PREPARATION AND ANALYTICAL REQUIREMENTS FOR ASBESTOS

SAP Title: Final Sampling and Analysis Plan for Recreational User Exposures at Operable Unit 5, Libby Asbestos Superfund Site, Libby, Montana

SAP Date/Revision: 09-08-08/N/A

EPA Technical Advisor: Kathryn Hernandez (303-312-6101, hernandez.kathryn@epa.gov)
(contact to advise on DQOs of SAP related to preparation/analytical requirements)

Sampling Program Overview: Collection of a series of activity-based samples (ABS) including personal air samples from a hiking/bicycle path located within OU5 of the Libby Asbestos Superfund Site. Additional personal air samples will be collected for health and safety monitoring.

Index ID Prefix: SL-

Medium-Specific TEM Preparation and Analytical Requirements for Field Samples:

Medium Code	Sample Type	Preparation Details				Analysis Details			Applicable Laboratory Modifications
		Investigative? (a)	Indirect Prep? (a,b)		Filter Archive? (b)	Method	Recording Rules	Analytical Sensitivity/ Stopping Rules	
			With Ashing (b)	Without Ashing (b)					
A	Outdoor ABS Personal Air Samples	Yes	Yes – if ≥ 30% loaded with organic material	Yes - if overloaded or unevenly loaded material on filter	Yes	TEM – ISO 10312	All asbestos L ≥ 0.5um AR ≥ 3:1	Count until one is achieved (i) Target S = 0.006 cc^{-1} (ii) 50 LA found, or (iii) An area of 0.5 mm^2 of filter evaluated (iv) For Chrysotile only: 50 found	LB-000016, LB-000019, LB-000028, LB-000029b, LB-000030, LB-000031a, LB-000053, LB-000066c, LB-000084, LB-000085
B	Health and Safety Personal Air Samples	No	No	Yes - if overloaded or unevenly loaded material on filter	Yes	PCM – NIOSH 7400 TEM – AHERA (upon request)	If AHERA is requested; All asbestos	For AHERA: evaluate 0.1 mm^2 of filter area	LB-000015, LB-000017a, LB-000019, LB-000028, LB-000029b, LB-000030, LB-000031a, LB-000053, LB-000066c, LB-000067, LB-000084, LB-000085

(a) See LB-000053 for additional details
(b) See most current version of EPA-LIBBY-08 for preparation details

TEM Preparation and Analytical Requirements for Quality Control Samples:

Medium Code	Sample Type	Preparation Details			Analysis Details			Applicable Laboratory Modifications
		Indirect Prep?		Archive?	Method	Recording Rules	Stopping Rules	
		With Ashing	Without Ashing					
C	Field Blank	No	No	Yes	TEM – ISO 10312	All asbestos L ≥ 0.5um AR ≥ 3:1	Evaluate 0.1 mm^2 of filter area	LB-000016, LB-000019, LB-000028, LB-000029b, LB-000030, LB-000031a, LB-000053, LB-000066c, LB-000084, LB-000085
D	Lot Blank	No	No	Yes	TEM – ISO 10312	All asbestos L ≥ 0.5um AR ≥ 3:1	Evaluate 0.1 mm^2 of filter area	LB-000016, LB-000019, LB-000028, LB-000029b, LB-000030, LB-000031a, LB-000053, LB-000066c, LB-000084, LB-000085

PLM Preparation and Analytical Requirements: N/A

Laboratory Quality Control Frequencies:

TEM: Lab Blank – 4%
Recount Same – 1%
Recount Different – 2.5%
Verified Analysis – 1%
Repreparation – 1%

PLM: Lab Duplicate – 10%

Requirements Revision:

Revision #:	Effective Date:	Revision Description
0	09-08-08	N/A

Analytical Laboratory Review Sign-off:

☒ Batta [sign & date: ___Bo Li, 9/8/08_____]
☒ EMSL-Libby [sign & date: R.K. Mahoney 5 September 2008]
☒ EMSL – Westmont [sign & date: ____Charles LaCerra, 9/8/08
☒ EMSL – Beltsville [sign & date: Joseph M. Centifonti 9/9/08]
☒ ESAT [sign & date: ____Douglas Kent 09/09/08___]
☒ Hygeia [sign & date: __Kyeong Corbin 9/5/08_____]
☒ MAS [sign & date: Mike Mount 9/10/08_____]
☒ RESI [sign & date: _Jeanne Orr 9/9/08_____]

[Checking the box and initialing above indicates that the laboratory has reviewed and acknowledged the preparation and analytical requirements associated with the specified SAP.]

APPENDIX E
LIBBY ASBESTOS PROJECT RECORD OF MODIFICATION FORM

Record of Modification
to the
Libby Sampling and Quality Assurance Project Plan
Field Activities
LFO-0000__

Instructions to Requester: **Fax to contacts at bottom of form for review and approval.**
File approved copy with Data Manager at the Libby Field Office (LFO).
Data Manager will maintain legible copies in a binder that can be accessed by LFO personnel.

Project QAPP (circle one): Phase I (approved 4/00) Phase II (approved 2/01)
Removal Action (approved 7/00) Contaminant Screening Study (approved 5/02)
Other (Title and approval date):_____

SOP (Number and Revision No.):_____
_____
_____

Other Document (Title, Number/Revision): _____

Requester: _____ Title: _____
Company: _____ Date: _____

Description of Modification (attach additional sheets if necessary; state section and page numbers of SQAPP when applicable):_____
_____
_____
_____

Field logbook and page number Modification is documented on: _____

Implications of Modification: _____
_____
_____
_____

Duration of Modification (circle one):
Temporary Date(s):_____
Resident address(es): _____
_____

- If appropriate, attach a list of all applicable Index Identification numbers.

Permanent (complete Proposed Modification Section) Effective Date:_____

Potential Implications of Modification:_____
_____
_____
_____

Technical Review and Approval: _____ Date:_____
(Volpe Project Manager or designate)

EPA Review and Approval: _____ Date:_____
(USEPA RPM or designate)